

# THREAD FORM AND CLEARANCE OF THREAD GAGES.

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Gage Section  
Bureau of Standards  
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6 Sheets.

One of the benefits to be realized as a result of the experience gained during the recent military preparations by American Engineers and Manufacturers is the more extensive and intelligent use of gages, particularly thread gages. We have become accustomed to using thread gages having certain clearances provided, but the requirements making these clearances desirable or necessary have not been generally understood. It is the purpose of this communication to present and discuss the conditions necessary for clearance as they may be attained in practice as well as the ideal conditions desirable in a system of "Go" and "Not Go" U.S. Standard thread gages. It is a further object to point out the utility of the Projection Lantern in determining clearance and thread form.

## 1. Ideal Form of the "Go" Thread Gage.

The thread form of the "Go" plug or ring thread gage which would best fulfill requirements is that of the perfect U.S. Standard thread, that is, a thread having an angle of  $60^\circ$  with sides straight, and the crest and root of the thread truncated at one-eighth the depth of the sharp V thread, as illustrated in Fig. 1. Work made to fit such a "Go" gage would not, on any of its diameters, extend beyond the limits established by that gage.

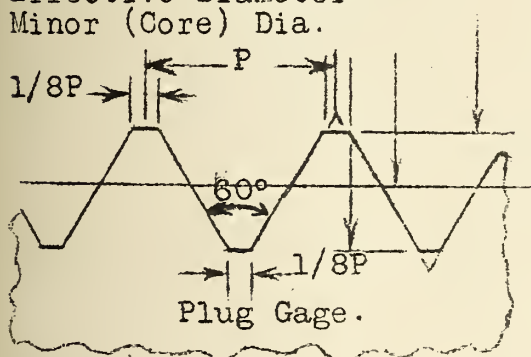
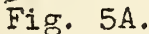


Fig. 1.

## 2. Usual Form for the "Go" Gage.

In the manufacture of a thread gage it is difficult to maintain an accurate form at the root of the thread and it is, therefore, the usual practice to clear out the root below the specified position of the U.S. Standard flat. This practice facilitates the lapping of the thread since it is practically impossible to lap the flat at the bottom of the thread shown in Fig. 1 and at the same time lap the sides of the thread accurately. If the root of the thread is cleared with a sharp  $60^\circ$  tool, the gage after lapping has the appearance shown in Fig. 2 at "A" since the lap wears away the sides of the thread with-

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line is considerably reduced.

In making this form of gage the major (outside) diameter and the minor (core) diameter need not be kept within close limits and need not be finished by grinding and lapping after hardening. It is only necessary to finish, grind and lap the pitch diameter. It is suggested that the thread be cleared not below the bottom of the sharp V thread. See Fig. 6. The practice outlined is recommended for both "Not Go" plug and ring thread gages.

### 6. Master Check Plugs For Thread Ring Gages.

In order to determine the pitch diameter of a ring thread gage it is the customary practice to fit it to a threaded check plug made to the correct pitch diameter. It is recommended that the thread form of such a check be the same as that recommended for the "Not Go" thread gage illustrated in Fig. 6. To insure clearance of the thread ring gage at the major diameter, a cast of the thread should be examined by the Projection Lantern as explained in a later paragraph. If such a lantern is not available the clearance should be tested by means of a threaded check plug having the major diameter of the "Go" or maximum size and with angle relieved so that it will not have bearing in the ring gage on the sides of the thread but only at the crest. This check plug can be used to inspect the clearance of both the "Go" and "Not Go" thread ring gages, if the angle is sufficiently relieved. The core diameter of a "Go" ring gage should be checked by a plain plug gage. If the "Not Go" ring gage is made according to the practice recommended herein, it is not necessary to check its core diameter.

### 7. Clearance On Gages Having Other Thread Forms.

#### (A) Lowenherz Thread Gages.

The above considerations apply in the same way to thread gages having the Lowenherz thread form since this form differs essentially from the U.S. Standard form only in that the thread angle is  $53^{\circ} 8'$  instead of  $60^{\circ}$ .

#### (B) Briggs Standard Pipe Thread Gages.

In order to insure a tight joint, that is, bearing on the sides of the thread, in fittings having the Briggs Standard Pipe Thread, the practice of reducing the crest and of clearing the root of the thread of the gage is recommended. For example, if the plug gage is made with the full form thread it may bear in the work at the crest or root and accordingly the gage will not enter until there is bearing on the sides of the thread. Thus the gage would indicate that the effective diameter of the fitting is smaller than its actual dimension. For general

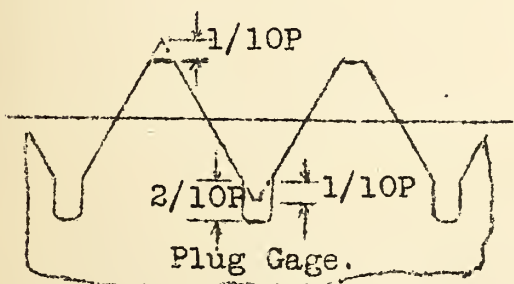


Fig. 7.

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practice it is recommended that the crest of the thread on the gage be removed to a depth of one-tenth the pitch, and that the root be cleared to a point one-tenth the pitch above the bottom of the sharp thread as shown in Fig. 7. This practice has been recommended by the Committee of Manufacturers on Standardization of Fittings and Valves.

#### 8. Application Of The Projection Lantern For Determining Clearance And Thread Form.

The Optical Projection Lantern affords a means by which the thread form and clearance of thread gages can be easily and quickly determined. The design and specifications of the projection lantern used by the Gage Section, Bureau of Standards, are available in Bureau of Standards Communication B510. A lantern of more simple design and cheaper construction especially adapted for use in manufacturing plants is being developed at the present time. The specifications for this lantern will be available in the near future.

By means of the lantern the thread form and clearance are best determined by a comparison of the projected, magnified, shadow with templets or charts on which are drawn the correct forms of threads. These charts are as many times enlarged over the exact thread form of a given pitch as the shadow projected by the Lantern is magnified. The magnification of the lantern can be determined by measuring the projected shadow of a wire or small plug of a known size.

The root of a thread is very often rounded out. If the points at which the curved portion is tangent to the straight sides of the thread are above the position at which the standard flat would be located, the thread is not clear.

The thread form and angle of a threaded ring gage may be inspected by examining a cast of the thread made by pouring a fused mixture of about 90% sulphur and 10% graphite into the thread. Unless the ring is very small the cast is readily removed after cooling.

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country.

The second part of the report deals with the economic situation of the country. It is a very interesting and informative study of the country's economic development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's economic development.

The third part of the report deals with the social situation of the country. It is a very interesting and informative study of the country's social development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's social development.

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The following table of U.S. Standard Screw Thread dimensions is useful in connection with the work dealt with in this communication:

COARSE THREADS.

No. of Thds. per Inch.	h Single Depth	2h Double Depth	Width of Flat	Depth of Truncation:	Pitch
4	.1624	.3248	.0312	.02702	.2500
5	.1299	.2598	.0250	.02165	.2000
6	.1083	.2165	.0208	.01801	.1667
7	.0928	.1856	.0179	.01550	.1430
8	.0812	.1624	.0156	.01351	.1250
9	.0722	.1443	.0139	.01204	.1111
10	.0650	.1299	.0125	.01082	.1000
11	.0590	.1181	.0114	.00987	.0909
12	.0541	.1083	.0104	.00900	.0833
13	.0500	.0999	.0096	.00831	.0769
14	.0464	.0928	.0089	.00770	.0714
16	.0406	.0812	.0078	.00675	.0625
18	.0361	.0722	.0069	.00597	.0556

FINE THREADS.

20	.0325	.0650	.0062	.00537	.0500
22	.0295	.0590	.0057	.00493	.0454
24	.0271	.0541	.0052	.00456	.0417
28	.0232	.0464	.0045	.00389	.0357
30	.0217	.0433	.0042	.00363	.0333
32	.0203	.0406	.0039	.00337	.0312
36	.0180	.0361	.0035	.00303	.0278
40	.0162	.0325	.0031	.00268	.0250
44	.0148	.0295	.0028	.00242	.0227
48	.0135	.0271	.0026	.00225	.0208
56	.0116	.0232	.0022	.00190	.0179
64	.0101	.0203	.0020	.00173	.0156
72	.0090	.0180	.0017	.00147	.0139
80	.0081	.0162	.0016	.00138	.0125





